US005650601A

United States Patent [19]

Krueger et al.

[11] Patent Number: 5,650,601

[45] Date of Patent: Jul. 22, 1997

[54] **SEALED SWITCH ASSEMBLY FOR USE WITH A ROTATABLE VALVE SHAFT**

[75] Inventors: **Donald M. Krueger**, Westchester, Ill.; **Paul D. Frazier**, West Plains, Mo.

[73] Assignee: **Eaton Corporation**, Cleveland, Ohio

[21] Appl. No.: **479,094**

[22] Filed: **Jun. 6, 1995**

[51] **Int. Cl.**[6] **H01H 9/06**

[52] **U.S. Cl.** ..... **200/61.86**; 200/11 R

[58] **Field of Search** ..... 200/11 R–11 TW, 200/61.85, 61.86, 293, 295, 302.1

[56] **References Cited**

U.S. PATENT DOCUMENTS

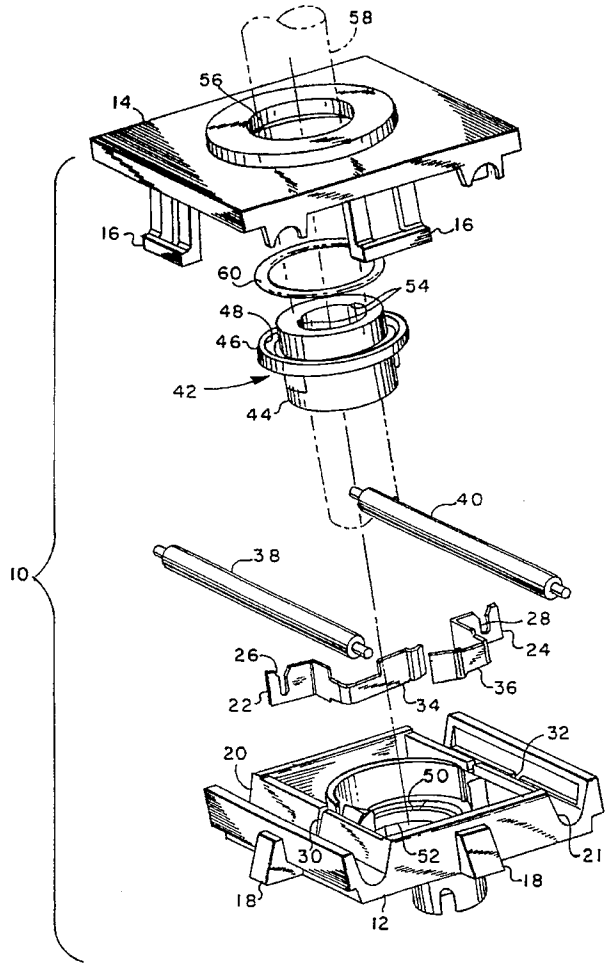
3,502,835	3/1970	Batcheller	200/154
3,971,904	7/1976	Ward	200/6 BB
4,016,387	4/1977	Aberer	200/303
4,019,855	4/1977	Camillo	431/256
4,249,047	2/1981	Huff et al.	200/61.86
4,342,886	8/1982	Demi	200/61.86
4,371,764	2/1983	Runion	200/61.86
4,612,423	9/1986	Munroe	200/16 R
5,008,498	4/1991	Yamazaki	200/11 R

Primary Examiner—Michael L. Gellner
Assistant Examiner—Michael A. Friedhofer
Attorney, Agent, or Firm—Roger A. Johnston

[57] **ABSTRACT**

A gas burner valve switch having an annular rotor engaging the valve shaft for rotation with the shaft. An annular resilient seal in a groove on the rotor flange seals against the underside of the casing cover to prevent entry of foreign matter. The rotor is journalled for rotation in the housing which has spaced terminals which connect, via insulation displacement, with a pair of continuous spaced electrical leads laid in channels and extending through the housing. In one embodiment the rotor has a cam which actuates a moveable blade arm attached to one of the pair of terminals to effect closing against the other terminals. In another embodiment an annular wiper ring acts as a shorting bar between the terminal for switching upon user rotation of the rotor.

10 Claims, 3 Drawing Sheets



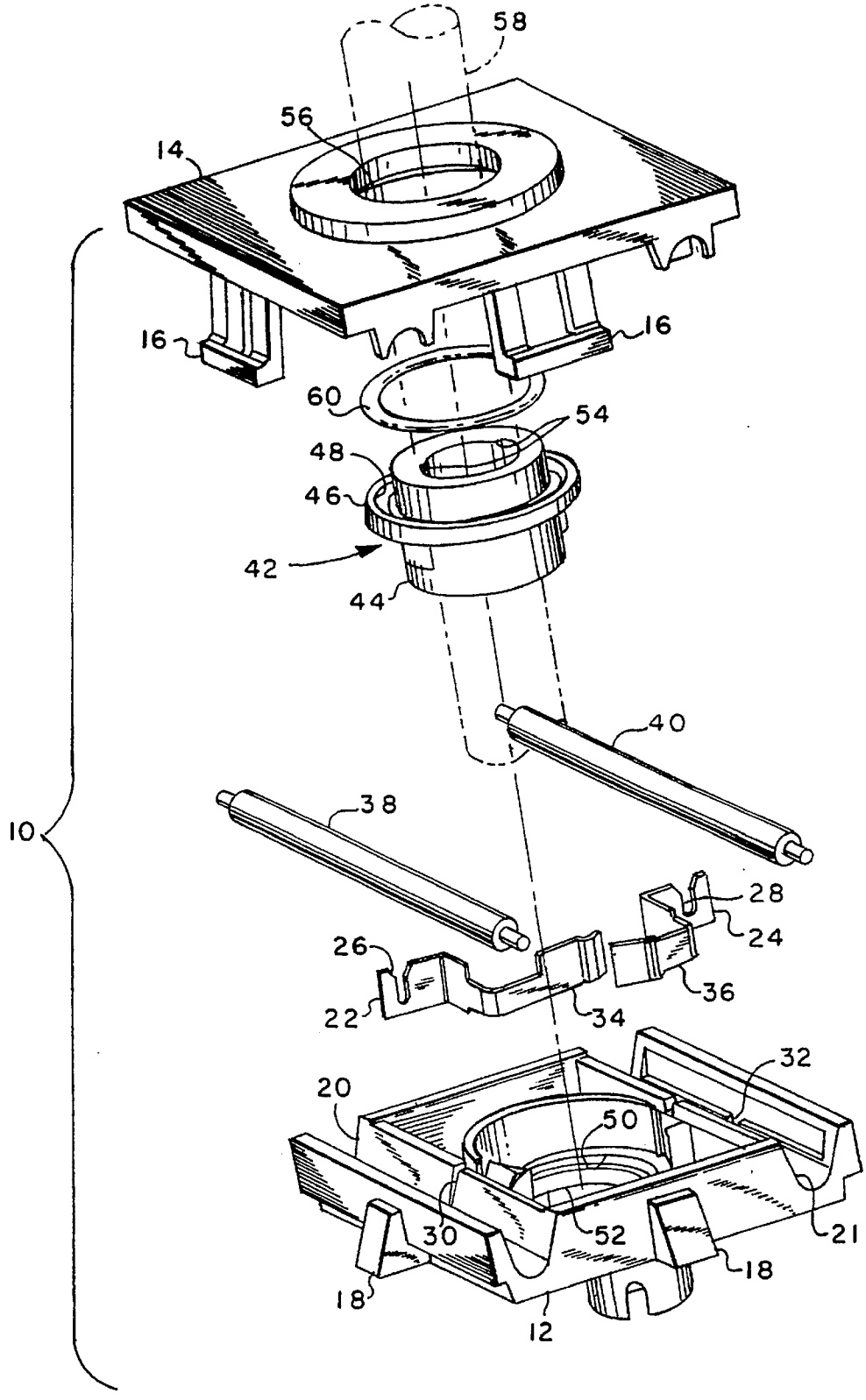

58
56
14
16
16
60
54
48
46
42
44
40
38
10
28
24
26
36
22
34
32
20
50
30
52
21
18
18
12

FIG. 1

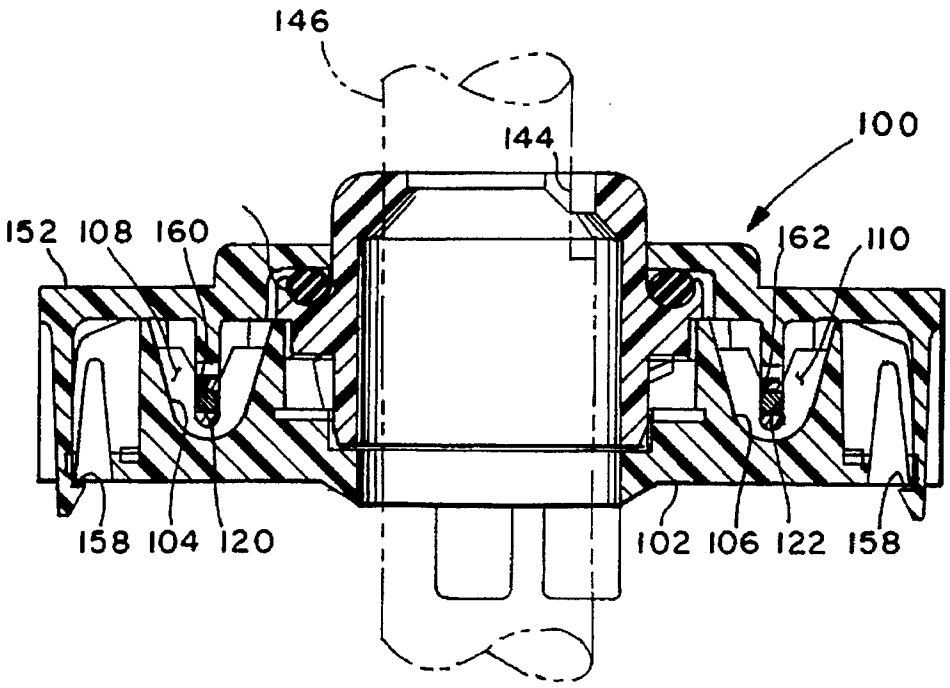

146
144
100
152
108
160
162
110
158
104
120
102
106
122
158

FIG. 4

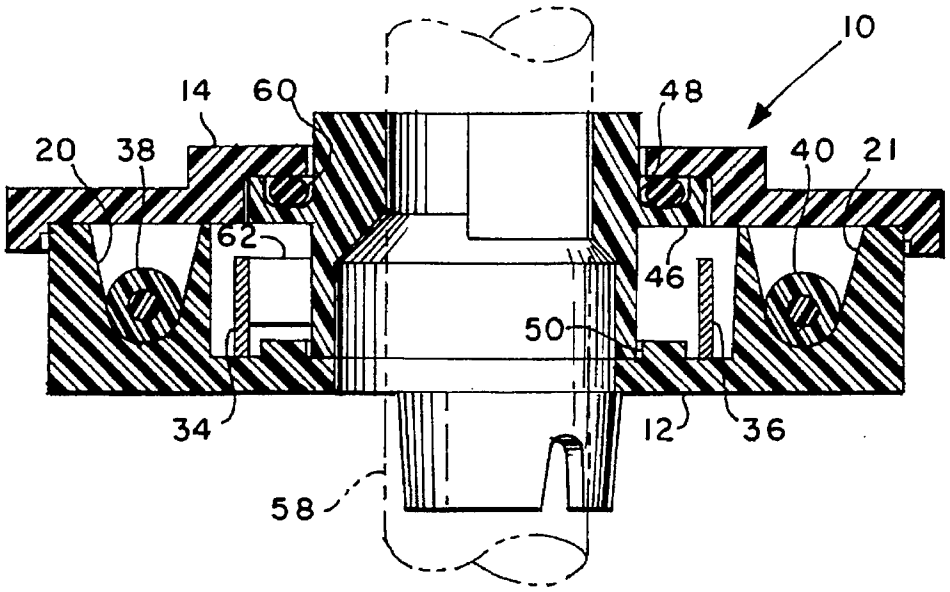
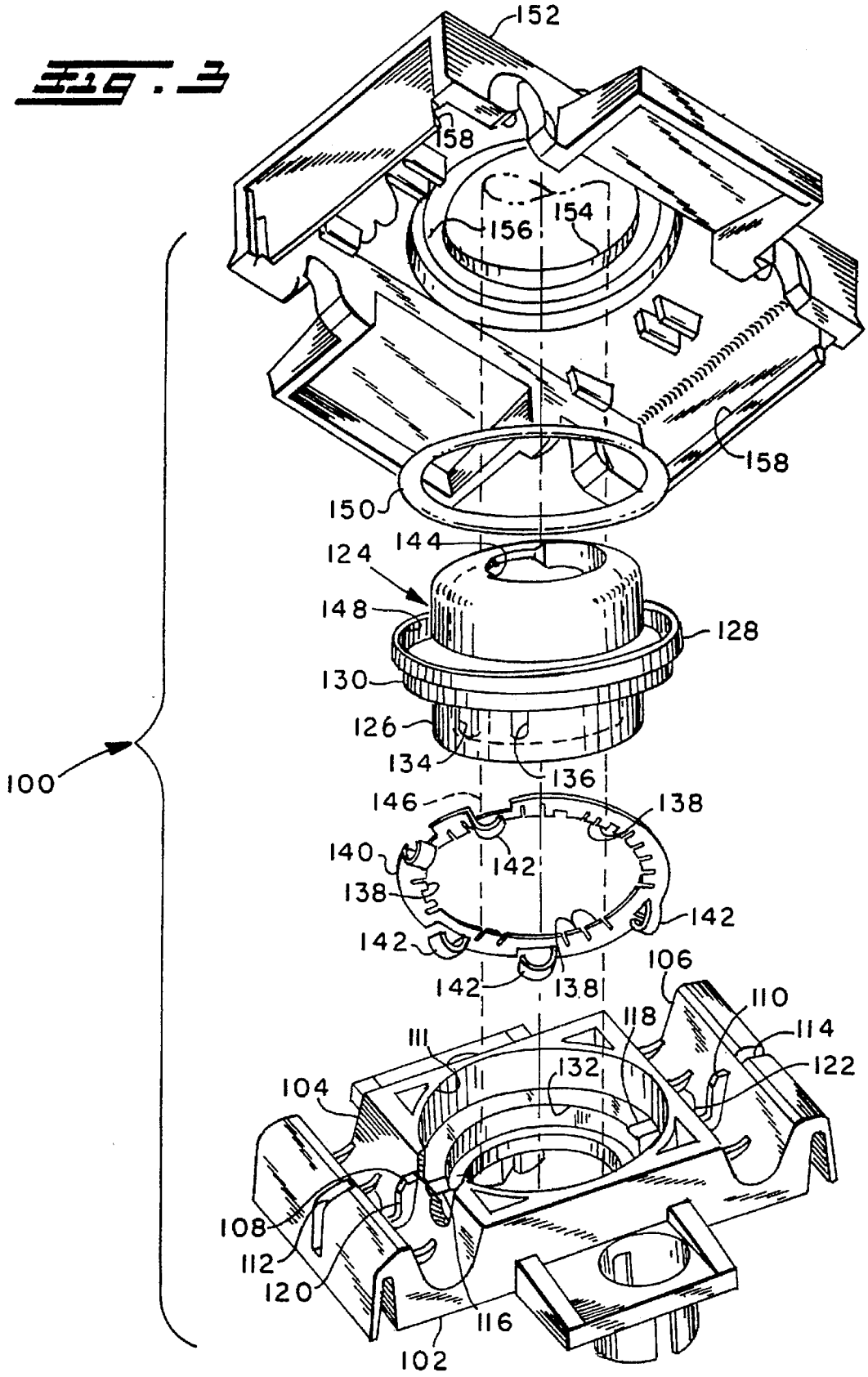

10
14
60
48
20
38
40
21
62
46
50
34
12
36
58

FIG. 2

Fig. 3


152
158
154
156
158
150
144
124
148
128
130
126
134
136
146
138
140
142
138
142
142
142
138
106
110
118
114
111
132
122
104
108
112
120
116
102
100

SEALED SWITCH ASSEMBLY FOR USE WITH A ROTATABLE VALVE SHAFT

BACKGROUND OF THE INVENTION

The present invention relates to switches of the type adapted to be received over a rotatable shaft and particularly a rotatable valve shaft such that upon user rotation of the valve shaft to a desired position, the switch is actuated or deactuated for making or breaking a circuit. Such switches are employed in valves utilized for controlling flow to range top gaseous fuel burners where the valve shaft is arranged to extend through the switch and has a knob provided on the end thereof to facilitate manual actuation by the user. In gas burner valve applications, it is commonplace to have the switch close a circuit for energizing an electrical spark ignitor when the burner valve shaft has been rotated to a desired predetermined position for opening of the gas valve to permit fuel flow to the burner.

In gas burner valve switch applications, problems have been experienced with spillage of foodstuffs and liquids on the range tops and seepage of same into the interior of the switch resulting in contamination of the contacts and deterioration of the switch performance. This has been particularly troublesome where the gas burner ignitor switch is received over the shaft of the individual burner valve and secured to the valve body by fasteners such that one side of the switch is registered against the valve body and the remaining portions of the switch are exposed to the burner well in the range top. Thus, it has been desired to provide a way or means of protecting the switch in gas burner valve applications from contamination particularly from liquid foodstuffs which could result in deterioration of the electrical switch contacts within the switch housing. It has also been desired to provide a reliable gas burner valve switch that is resistant to contamination and which is economical to manufacture in high volume productions for consumer appliance applications. It has also been desired to provide a rotary switch, adapted for receipt on a shaft, which is resistant to contamination and which may be attached to continuous electrical leads.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a sealed switch assembly for use with a rotatable shaft and particularly the shaft of a rotatable valve.

It is a further object of the present invention to provide a sealed switch assembly for use with a rotatable shaft and which is simple in design and has a relatively low manufacturing cost and provides reliable switching upon rotation of the shaft to a predetermined position.

It is a further object of the present invention to provide a switch adapted for receipt on a rotatable valve shaft which is resistant to contamination and which may be connected to continuous electrical leads.

The present invention employs an annular rotor adapted to be received over a shaft in driving engagement such as a valve shaft and which is rotatable therewith, the rotor being journalled in a housing containing a switch operative for making and breaking a circuit responsive to rotation of the rotor to a certain position. The rotor has an annular flange extending radially outwardly therefrom which has provided between the flange and the housing an annular seal ring for sealing the rotor against the housing. The housing has a pair of spaced terminal means provided therein which are adapted to receive therein in electrical contact by insulation displacement a pair of continuous electrical leads passing through the switch housing. Electrical switch means are provided within the housing for, upon rotation of the rotor, effecting the making and breaking of an electrical circuit between the spaced terminal means. In one embodiment the switch means comprises a moveable blade member actuated by a cam on the rotor; and, in another embodiment the switch means comprises an arcuate shorting bar rotatable with a rotor for effecting the making and breaking of electrical contact between the spaced terminal means.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an exploded view of one embodiment of the invention employing a rotary cam actuated switch;

FIG. **2** is a cross-section of the switch of FIG. **1** in the assembled condition;

FIG. **3** is a view similar to FIG. **1** of an alternate embodiment of the invention employing a rotatable shorting bar; and,

FIG. **4** is a cross-section of the embodiment of FIG. **3** in the assembled condition.

DETAILED DESCRIPTION

Referring to FIGS. **1** and **2**, the switch assembly of the present invention is illustrated generally at **10** and includes a base preferably in the form of an open shell **12** and a cover **14** releasably attached to the base by any convenient expedient such as snap tabs **16** which are engaged over lugs or barbs **18** provided on the base. The base has a pair of spaced generally parallel channels **20**, **21** for electrical leads as will hereinafter be described.

A pair of electrical terminals **22**, **24** are formed preferably of strip material with a wire receiving slot formed therein denoted by reference numerals **26**, **28** respectively. The terminal **22** is received in a recess or slot **30** formed in the side of channel **20** with terminal **24** received in a corresponding recess or slot **32** formed in the side channel **21**. Terminal **22** has a moveable contact blade arm portion **34** formed integrally therewith; and, terminal **24** has a contact arm **36** formed integrally therewith and extending therefrom. Contact arm **36** in the illustrated embodiment functions as a stationary contact; whereas, contact blade arm **34** functions as a moveable contact blade as will hereinafter be described. With the terminals **22**, **24** received in the slots in the base **12**, individual electrical leads **38**, **40** are pressed in the slots **28**, of each terminal with the edges of the slots displacing or piercing the insulation on the leads and making electrical contact with the conductor therein enabling the leads to be received in and passed through the switch housing **12** as a continuous member without the need to break the leads for connection or form a splice.

An annular rotor indicated generally at **42** has a hub portion **44** and an annular radially outwardly extending flange **46** which has a groove **48** formed in one axial face of the flange. The hub **44** is journalled for rotation in annular groove **50** provided in the base **12** which is concentric with an aperture or cut-out **52** formed therethrough, the annular groove **54** allowing free access to the lower end of the hub **44**. Hub **44** has the inner periphery thereof provided with a pair of oppositely disposed flat portions **54** which are adapted to engage a corresponding flat surface (not shown) on the shaft of a rotary valve. The valve shaft is indicated in dashed outline in FIG. **1** and denoted by reference numeral **58**. Similarly, a cut-out or aperture **56** is provided in the cover **14** for permitting the valve shaft **58** to extend through the rotor **42** and outwardly through the cover **14**.

An annular resilient seal, preferably in the form of a O-ring **60**, is received in the groove **48** in the rotor flange and seals the flange against the undersurface of the cover **14** to prevent entry of foreign matter into the interior of the housing.

Rotor hub **44** includes at least one cam lobe **62** provided on the rotor for, upon rotation, effecting movement of the contact blade **34** to close against the contact **36**.

Referring to FIGS. **3** and **4**, another embodiment of the invention indicated generally at **100** comprises a lower shell or base **102** having a pair of spaced parallel channels **104**, **106** formed therethrough adapted to receive electrical leads in a manner similar to the channels **20**, **21** of the embodiment of FIG. **1**.

A pair of contact terminals **108**, **110** are disposed on opposite sides of a central cavity **111** formed in the base, with the terminals each received in a cut-out or slot denoted respectively **112**, **114** extending transversely to the grooves **104**, **106**. Each of the terminals **108**, **110** has a portion thereof extending through the wall of the channels and into the cavity to form stationary electrical contacts denoted by reference numerals **116**, **118** respectively.

Each of the terminals **110**, **112** has a slot denoted respectively **120**, **122** formed therein which is adapted to have a continuous electrical lead received therein such that the slot displaces or cuts the lead insulation and makes electrical contact with the conductor in the lead. It will be understood that the electrical leads have been omitted in FIG. **3**, but are shown in FIG. **4**.

An annular rotor indicated generally at **124** has a hub **126** with an annular flange extending radially outwardly therefrom as denoted by reference numeral **128** which has an annular shoulder **130** provided thereon which is registered in a journalling counter-bore **132** provided in the base. The counter-bore **132** and shoulder **130** function as a labyrinth to trap foreign matter from entering the interior of the switch housing over the lower end of the hub. The rotor hub **126** has formed thereon a plurality of recesses **134**, **136** spaced thereabout. Recesses **134**, **136** are engaged by correspondingly spaced tabs **138** disposed about the inner periphery of a conductor ring **140** which is press fitted over the hub **126** to register against the undersurface or lower axial face of flange **128**. The tabs **138** snap into the grooves **134**, **136** to provide transmission of torque between the hub **126** and the ring **140**. The wiper ring **140** has a plurality of wiper contacts **142** extending from one axial phase thereof in a generally downward direction in FIG. **3**.

The rotor **124** has a pair of spaced flat surfaces **144** formed on the inner periphery thereof which are adapted for driving engagement with a corresponding flat surface (not shown) formed on a valve shaft **146** indicated in dashed outline in FIG. **4**. The enlarged diameter flange **128** of the rotor has an annular groove **148** formed in the axial surface thereof opposite the conductor ring **140**; and, groove **148** has received therein an annular resilient seal ring, preferably an O-ring, denoted by reference numeral **150**.

A cover member forming part of the switch assembly housing is indicated at **152** and has formed therein an aperture **154** which is received over the hub of the rotor and has a counterbore surface **156** formed on the inside thereof which surface contacts and seals against the O-ring **150**. Cover **152** has releasable attachment means thereon comprising in the illustrated embodiment **100** barbed tabs on the sides thereof indicated by reference numerals **158**, which barbs engage the sides of the base **102** for releasable snap locking engagement of the cover **152** over the base **102**.

It will be understood that rotation of the valve shaft **146** by the user effects rotation of rotor **124** and conductor ring **140** to cause the wiper contacts **142** to short across the stationary contacts **116**, **118** for completing a circuit between the electrical leads denoted by reference numerals **160**, **162** in FIG. **4**.

The present invention thus provides a unique and novel switch assembly adapted for being received over a rotatable shaft, particularly a valve shaft, wherein the switch has an annular rotor which is engaged by surfaces on the shaft and rotated thereby. Rotation of the switch rotor effects making and breaking of contacts interiorly of the switch housing which has a pair of continuous electric leads pressed therein for insulation displacing electrical contact with the conductor in the leads and secured by a cover snapped over the housing. An annular seal ring on the rotor seals against the undersurface of the cover and protects the contacts within the switch housing from contamination by foreign matter. The switch is thus ideally suitable for use with a gas burner valve shaft for controlling the spark ignitor circuit upon user rotation of the valve shaft to a position permitting fuel to flow to the burner.

Although the present invention has hereinabove been described with respect to the illustrated embodiments, it will be understood by those having ordinary skill in the art that the invention is capable of modification and variation and is limited only by the following claims.

We claim:

1. A switch assembly for use with a valve having a rotatable shaft comprising:

(a) housing means comprising a base and a cover releasably attached to said base, said base and cover each having a cut-out therein;

(b) a pair of spaced generally parallel insulated electrical conductors, each extending continuously through said housing means;

(c) first and second spaced electrical terminal means each disposed in one of said base and cover and each operative to make electrical contact through said insulation with one of said electrical conductors received through said housing means, said first and second terminal means including a first electrical contact means;

(d) an annular rotor in driving engagement with said valve shaft, said rotor disposed in said housing with an inner periphery of said rotor aligned with said cut-outs;

(e) a switching means operable upon rotation of said rotor to close said first and second contact means to complete a circuit between said first and second terminal means; and,

(f) annular seal means operative to provide a rotatable seal between said rotor and at least one of said base and cover.

2. The switch assembly defined in claim **1**, wherein said switching means is formed by said rotor including a cam and one of said first and second contact means including a moveable blade operably moved by said cam to close against the other of said first and second contact means.

3. The switch assembly defined in claim **1**, wherein said switching means includes a shorting bar mounted for rotation on said rotor and operable to complete a circuit between said first and second contact means.

4. The switch assembly defined in claim **1**, wherein said switching means includes an annular conductive member mounted for rotation with said rotor; and, said first and second contact means includes a pair of stationary contacts

and said annular member has portions thereof operable upon rotation of said rotor, to complete a circuit between said stationary contacts.

5. The switch assembly defined in claim **1**, wherein said annular seal means comprises a resilient O-ring.

6. The switch assembly defined in claim **1**, wherein one of said first and second contact means includes a moveable contact blade attached to one of said first and second terminal means, and said annular rotor includes a cam operable upon rotation of said rotor to effect movement of said contact blade.

7. The switch assembly defined in claim **1**, wherein said housing means includes an open shell member having said terminal means mounted therein and a cover member releasably attached to and closing said shell.

8. The switch assembly defined in claim **1**, wherein said rotor has an annular radially outwardly extending flange having an annular groove formed therein with said annular seal means disposed in said groove.

9. The switch assembly defined in claim **1**, wherein said pair of electrical conductors passes through said base.

10. The switch assembly defined in claim **1**, wherein one of said first and second contact means includes a member moveable by said rotor.

* * * * *